

SECTION 1203

CENTRIFUGAL BOOSTER PUMP & MOTOR

1203.0100 GENERAL

1203.0101 Description of Work. The work under this Section shall consist of furnishing all labor, materials, equipment, and appurtenances required for the installation and testing of centrifugal booster pumps and motors, in accordance with the details shown on the plans, special specifications, and the requirements of these specifications.

It is the intent of these specifications to obtain a high-efficiency, durable, centrifugal pump and motor of heavy-duty construction for continuous service or for intermittent service, whichever imposes the most severe conditions on the pump. Pumps with mechanical defects or not meeting the range or head-capacity characteristics, horsepower, and efficiency requirements will be rejected after testing and shall be replaced without additional cost to the Owner for furnishing, removal, reinstallation, and retesting. Mechanical defects shall include the following:

- Excessive vibration
- Improper balancing of any rotating parts
- Improper tolerances
- Binding
- Excessive bearing heating
- Defective materials, including materials that do not conform to the specifications
- Improper fitting of parts
- Any other defect that will, in time, damage the pump or unreasonably impair its efficiency

1203.0102 Related Specifications.

- Section 0105 – Control of Material (standard contract conditions)

1203.0103 Submittals. All submittals shall be clean, legible prints that are easily reproduced and shall reference the Tucson Water project plan number.

Five sets of shop drawings and literature shall be submitted for each centrifugal booster pump and motor. Shop drawings and literature, together with an assembly drawing showing the entire pump and motor assemblies, shall include detailed specifications and drawings indicating the following:

(A) Pump.

SECTION 1203

(1) Pump curves and literature. The pump performance curve and literature for the specific impeller diameter—as well as the entire operating range of the pump including shut-off head—shall include:

- Head-capacity curve with design point indicated
- Horsepower requirement curve
- Efficiency curve
- NPSHR curve
- Impeller type, part number, and diameter trim
- Dimensioned assembly drawing detailing the entire centrifugal booster pump and motor

See sample pump curve at the end of this Section for required information and proper data plotting. Failure to comply with these requirements will result in rejection of the submittal.

(2) Manufacturer.

(3) Model number.

(4) Design full-load speed.

(5) Nominal size.

(6) Design speed.

(7) Component materials.

(8) Any other noteworthy design features.

(B) Motor.

(1) Manufacturer.

(2) Model.

(3) Horsepower.

(4) Rated RPM.

(5) Efficiency.

(6) Full-load amps.

SECTION 1203

(7) Dimensioned assembly drawing.

(8) Certified performance data. The motor shall have short commercial tests performed that include:

- No-load current
- Locked-rotor current
- Winding resistance
- High potential
- Vibration and bearing inspection

Certified copies of test reports on the short commercial test performed on a comparable motor shall be submitted for review as part of the shop drawing submittal. Certified performance data—in the form of a computer analysis or complete initial test on a motor comparable to the one provided—shall be submitted for review as part of the shop drawing submittals. Complete initial test data for a comparable motor shall include, but not be limited to:

- Full-load heat rise
- Percent slip
- Breakdown torque
- Locked-rotor torque
- Efficiency
- Power factor at full, 3/4, and 1/2 load

1203.0104 Delivery, Storage, and Handling. Centrifugal booster pumps and motors shall be delivered to the site, stored, and handled in accordance with the manufacturer's instructions except as may be modified by the plans, special specifications, or as directed by the Engineer. The equipment shall be packaged, shipped, and handled in such a manner that no damage will result to any component. Precaution shall be exercised in handling so as to avoid imposing strain on any part of the pump and motor.

1203.0200 PRODUCTS

1203.0201 Materials.

(A) Pump. The pump(s) furnished shall comply with the capacity and minimum working pressure noted on the plans or in the special specifications. The pump shall be of integral horsepower, single suction, end suction type, either flexible or close-coupled.

Pump performance characteristics shall be as noted on the plans or in the special specifications and shall include the following:

SECTION 1203

- Design capacity (gallons per minute)
- Design total pumping head (pump lift in feet)
- Minimum allowable lab efficiency (percent) at Design Point
- Minimum operating pumping head (pump lift in feet)
- Minimum allowable lab efficiency (percent) at minimum operating pump head
- Minimum shutoff head (feet)
- Rated RPM
- NPSH required
- Minimum horsepower

The casing shall be constructed of smooth grained cast iron. Each unit shall be base mounted, ready for pad mounting, and the pump and electric motor assembly aligned prior to shipment to the site. The casing shall be designed to permit disassembly from the rear to remove pump internals without disturbing the system piping. The casing shall be NPT tapped and plugged at two locations, 1/2 inch maximum.

Flanged casing nozzles shall conform to ANSI B16.1 with a minimum 125-psi rating. All flanged connections shall be flat face.

(1) Mechanical Seal. Each pump shall have a mechanical shaft seal mounted on a stainless steel or bronze sleeve. Wearing rings shall be replaceable, positively locking, and shall fit to permit a minimum of recirculation.

(2) Impellers. Unless otherwise indicated on the plans or in the special specifications, impellers shall be a lead-free bronze that is NSF/ANSI 61 certified. Impellers shall be accurately keyed to the pump shaft and securely fixed.

(B) Motor. The pump shall be supplied with a squirrel cage induction motor of the required horsepower. The motor shall operate below motor nameplate full-load amps for the entire range of the pump curve on all 3 phases. Motors 50 horsepower or larger shall be provided as 6 lead 1/2 - 1/2 part wind motors.

The motor shall be 460 Volts, 3 Phase, 60 Hertz, and shall be of guarded, drip-proof construction. The motor shall be rated for continuous duty.

The motor shall be designed, manufactured, and tested in accordance with NEMA MG-1 Standards. The following information shall be as indicated in the special specifications and shall be stamped on a permanently affixed, engraved stainless steel motor nameplate:

- Motor insulation class
- Temperature rise class
- Ambient temperature rating
- Design class

SECTION 1203

- Service factor
- Horsepower
- Number of phases
- Voltage
- Frequency
- Frame size and type
- Full-load current
- Full-load RPM
- NEMA nominal efficiency
- Motor duty cycle (continuous)

The temperature rise of the motor shall be in accordance with the requirements for Class B at a service factor of 1.15. The ambient temperature rating shall be 40 degrees C at a maximum altitude of 3,000 feet. Motor insulation shall be Class F.

The conduit box shall be provided with a grounding terminal, and shall be sized to handle required conduit and wire.

The motor torque/speed curve shall be NEMA Design B.

Motor windings shall be copper with not less than 98 percent conductivity.

Nominal motor speed shall be as specified in the special specifications.

The motor shall be capable of continuous operation at full load and rated frequency, with a voltage variation of 10 percent above or below the rated voltage, provided the sum of the voltage and frequency variation does not exceed 10 percent, with the frequency variation not exceeding 5 percent.

The motor winding start configuration shall be as specified on the special specifications.

Motor bearings requiring lubrication with grease shall be equipped with Zerk-type fittings and grease relief plugs.

The motor shall be designed for 4 starts per hour at an ambient temperature of 40 degrees C when coupled to the pump load specified in the special specifications.

1203.0300 EXECUTION

1203.0301 Installation. Centrifugal pumps shall be furnished as specified by the plans, the special specifications, or as directed by the Engineer. Prior to installation, the Contractor shall furnish 5 sets of installation and lubrication instructions for each pump and motor. The

SECTION 1203

instructions shall include detailed information regarding pump adjustment, as well as recommendations for the proper type of lubricant.

Centrifugal pumps shall be installed and adjusted as specified in accordance with the manufacturer's recommendations and in such a manner that the connecting piping shall not impose any strain on the pump.

1203.0302 Testing. Unless otherwise specified, each pump and motor shall be field tested for compliance with the specified head-capacity, efficiency, and horsepower requirements. The Contractor shall furnish all manpower, facilities, power, and equipment required for conducting all tests. Field tests and manufacturers' tests will be conducted in accordance with the latest requirements of the Hydraulic Institute Standards.

(A) Vibration Measurements. Each pump shall be field tested for vibration and alignment after installation. Testing shall be as specified by the special specifications. Field tests shall be conducted using the fluid for which the pump was specified.

Vibration shall be tested with a Starret vibrometer or a vibrometer acceptable to the Engineer.

(B) Vibration Limits. The pump's vibration limits shall be as described in the Hydraulic Institute Standards. It shall be the Contractor's responsibility to dynamically balance the pump and motor, and to reinforce, stiffen, or support the pump, frame, or pedestal in order to provide vibration levels within the limits described herein.

(C) Installation and Operation. Each pump shall be operated by the Contractor for as long as required to ensure proper installation and operation. Following the operation by the contractor, the Agency will operate the pumps to determine whether they satisfy all the performance requirements listed in Subsection 1203.0301. The Contractor shall be responsible for making all adjustments required for proper operation.

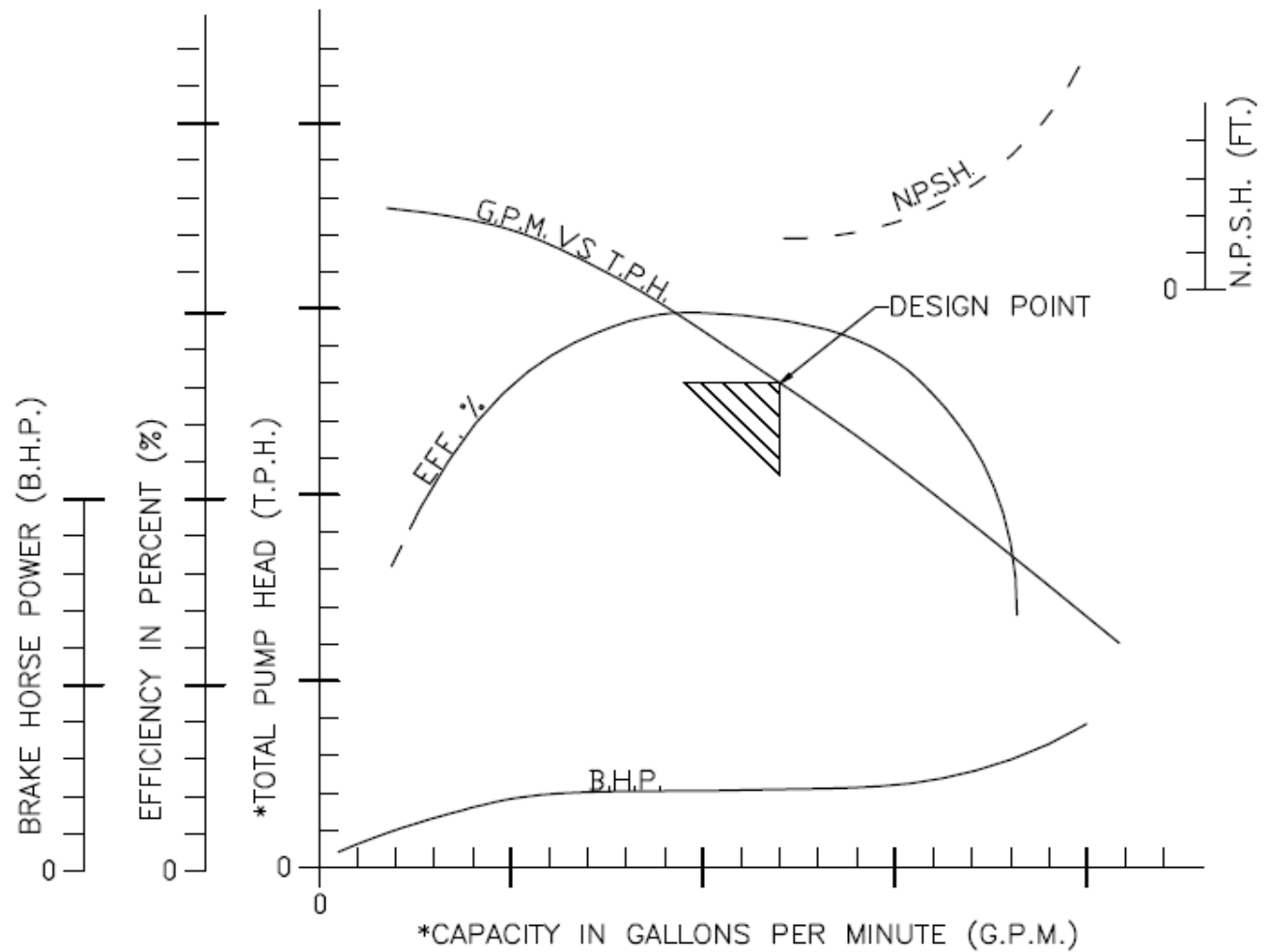
The pump shall be capable of operating against a closed discharge valve for not less than 2 minutes without excessive vibration, binding, rubbing of rotating parts, or damage to pump, motor, or coupling.

(D) Service Representative, Pump Manufacturer. The Contractor shall provide the service of a fully qualified, factory-trained service representative of the pump manufacturer to inspect the installation, witness the initial startup and testing, and make adjustments as necessary for proper operation. The Contractor shall make all provisions for the services of the manufacturer's representative for such periods of time as may be necessary to place the unit in satisfactory operating condition. The Contractor shall provide 3 complete sets of operating and maintenance instructions for the pumps/motor unit.

SECTION 1203

SAMPLE PUMP CURVE

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|----------------------------|-------------------------|
| 1. Manufacturer _____ | 5. Pump Model No. _____ |
| 2. Impeller Diameter _____ | 6. Design GPM _____ |
| 3. Design Head _____ | 7. RPM _____ |
| 4. H.P. _____ | 8. No. of Stages _____ |



*Range of capacity (GPM) and Total Pump Head (TPH) shall be of the size to properly demonstrate the pump operational characteristics throughout the entire pumping range of the pump. Failure to do so will result in rejection of the pump curve.